THE REALITY OF STERNITES IN THE MESOTHORAX OF HYMENOPTERA

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Surface sternal plates are not supposed to occur in the mesothorax of Hymenoptera according to a theory that was advanced by Ferris in 1940 and which has been widely accepted since then with few dissentions (Ferris, 1940). The most noteworthy dissenter is Snodgrass. He has not made any concessions to the Ferris theory. (Snodgrass, 1942, p. 48 and 1956, pp. 88-90.) Photographic evidence is presented here to show that external sternites do occur in the mesothorax of some Hymenoptera. In a systematic paper attention was directed to *Astymachus japonicus* How. and *Scelioencyrtus mymaricoides* Comp., Rao, Kaur., as having structural pecularities that might prove instructive to expert anatomists in tracing the evolution of the thorax in the Encyrtidae (Compere, Rao, and Kaur, 1960). This was an understatement. One need not be an expert anatomist to realize that these insects do more than this. They prove that the Ferris theory and the modifications of this theory by others concerning the morphology of the thorax in the Hymenoptera are untenable; that facts of anatomy have been forced to fit untenable theories; that evolution in the Hymenoptera does not follow a simple uniform basic pattern; that patterns may move in one direction and sometimes in another direction; that sclerites, ridges, sulci, and clefts may come into existence on stationary, pre-existing, substrates; that it is a mistake to assume that morphological regions necessarily follow shifts in the sclerotization.

Snodgrass regards the muscle connections as providing good permanent landmarks and what seems to be the most decisive evidence against the Ferris theory. In the honey bee (Snodgrass, 1956, fig. 49) the large tergo-sternal wing muscles of the mesothorax are not carried off by the sternum, which is supposed to migrate and invaginate according to the Ferris theory. It is hardly to be supposed that a migrating sternum should pass its muscles to an invading pleuron.

Nothing has been written above that is new or that has not been expressed or implied by Snodgrass in one place or another in his publications but in different words or communicated in letters.

Astymachus japonicus and *Scelioencyrtus mymaricoides* are not typical of the Encyrtidae, and may not fall in this family in a perfected classification. These two genera are so distantly related that they may not even belong in the same family. They resemble typical Encyrtidae in having large mesopleura with inner side walls and sterno-pleural ridges.[2] Aside from thoracic characters there is

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[2]These are the ridges which extend lengthwise from the lateral coxal articulations to the anterior margin of the mesopectus and to which Snodgrass applied the name sterno-pleural (Snodgrass, 1910, p. 80, and pl. 9, fig. 4). In this article sterno-pleural is restored to the ridges to which this name was applied in 1910 by Snodgrass.

little similarity between the typical Encyrtidae on the one side and *A. japonicus* and *S. mymaricoides* on the other side. The latter are highly specialized for crawling between the sheaths and culms of graminaceous plants for hosts living between closely appressed surfaces. The encyrtid parasites are paper thin and weakly sclerotized. In life the bodies may even be compressible. There is a correlation here between structure and habit giving support to the idea that the insect skeleton may be moulded by the mechanical needs of each kind of insect.[3] Generalizations have been made about the thorax in the Hymenoptera with little or no regard for the Chalcidoidea—in some cases as if this important superfamily did not exist. Yet the Chalcidoidea is a major group by any standard. The species exist in enormous numbers and present an almost kaleidoscopic array of mesothoracic patterns which do not conform to the basic plans that have been laid down for the Hymenoptera.

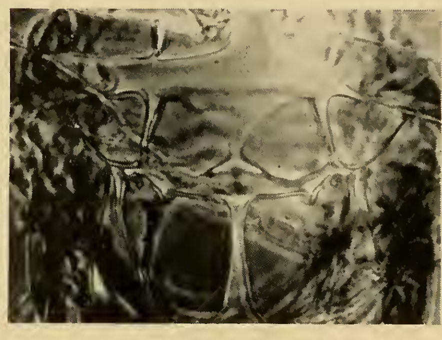
In typical Encyrtidae the region of the mesopectus between the sternopleural ridges is occupied by a large composite sclerite, while in *Astymachus japonicus* and *Scelioencyrtus mymaricoides* the corresponding region is occupied by two pairs of sclerites. It is evident that the regions between the sterno-pleural ridges are stationary and identical morphologically. It requires too great a stretch of imagination to believe otherwise.

The photographs of *Astymachus japonicus* and *Scelioencyrtus mymaricoides* show the two pairs of sclerites on the venter of the mesopectus between the sternopleural ridges. It is not exaggerating much to state that these sclerites bear identification labels with the name *furcasternite* on the inner pair and *laterosternite* on the outer pair. There is no median furca. The widely separated apophyses are carried on the lateral margins of the inner pair of sclerites and attach to the pleura distally. These apophyses are evidently homologous with the furcal arms of typical Encyrtids, therefore the sclerites on which they rest are identified as *furcasternites*. There is a striking similarity between the *furcasternites* in the Hymenoptera and the sternites associated with the first pair of legs in the symphylan, *Scutigerella immaculata* (Newb.). In the latter the long sternal apophyses are carried on the lateral margins of the sternites.

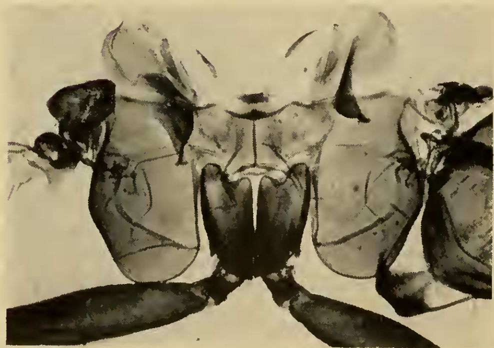
Presumably, objections will be raised to identifying sclerites in the Hymenoptera as sternites. It is clearly evident that the sternites in the Hymenoptera did not come into existence in the same way as those in the Blattidae. In the latter the sternites came into existence by the partial desclerotization of a pre-existing sclerotized sternum (Snodgrass, 1935, pp. 170-171, fig. 94). In the Hymenoptera the sternites appear to have come into existence by sclerotization on a pre-existing membranous substrate. This poses several questions. Is a membranous sternum antecedent to a sclerotized sternum in insects or *vice versa?* Should the same name or different names be applied

[3]This is not my idea but that of Snodgrass. It was contained in a personal letter under date of August 2, 1961.

A



B



C

Fig. 1.—Surface sternal plates in the mesothorax of Hymenoptera. Fig. A, *Astymachus japonicus* Howard; fig. B, *Scelioencyrtus mymaricoides* Compere, Rao, Kaur; fig. C, *Encyrtus fuliginosus* Compere. A and B cleared stained specimens photographed at 160X. C cleared specimen photographed at relatively low magnification with different equipment.

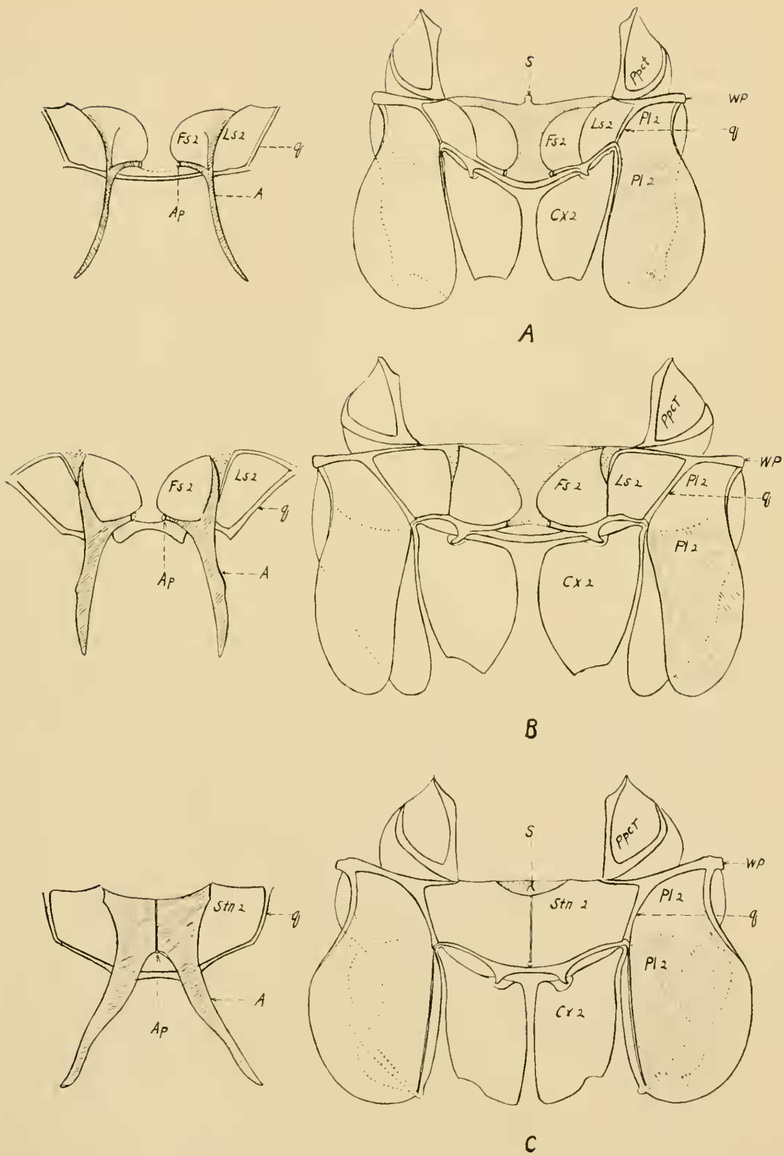


Fig. 2.—Simplified drawings of specimens shown photographically in fig. 1. The inner walls of the mesopleura and the sternal apophyses shown separately in the offset drawings are hatched. The membranous sternal substrate stippled in A, B, and C. Explanation of the lettering: *A*, apophysis; *Ap*, apophyseal pit; *Cx*, coxa; *Fs*, furcasternites; *Ls*, laterosternite; *Ppct*, prepectus; *Pl*, pleuron; *S*, spina; *Stn*, sternum; *q*, sterno-pleural ridge; *WP*, wing process.

to corresponding sclerites which have the same relative positions, proportions, and values but which came into existence by different processes?

The photographs do not show that the lateral margins of the *furcasternites* which carry the apophyses are raised slightly above the membranous substrate. This can be seen when the specimens are viewed at oblique angles. The widely separated apophyseal pits show clearly in the photograph of *Scelioencyrtus mymaricoides* but not in that of *Astymachus japonicus*, although the pits are present in the latter. The apophyses which arise from these pits presumably attach to the *furcasternites* secondarily.

Prior to studying *Astymachus japonicus* and *Scelioencyrtus mymaricoides* I took for granted that in the Chalcidoidea a spina was a cardinal landmark of identifying the venter of the prepectus when the latter is membranous as in the Encyrtidae and Eupelmidae. However, in *A. japonicus* the spina appears to be located anteriorly on the midline of the mesopectus, and in *S. mymaricoides* there is no spina on either the prepectus or mesopectus.

In the great majority of the Chalcidoidea examined by me only one apophyseal pit can be seen and this is located posteriorly on the midline of the mesopectus. In *Ophelosia crawfordi* Riley, an anomalous Chalcidoid now classified under the Pteromalidae, two microscopic pits can be seen close together in a small depression. This is not evidence that one apophyseal pit is indicative of primitiveness. Yet Ferris (1940, p. 88) reasoned that since in the majority of insects, probably 95 percent or more, the two apophyseal pits are close together on the midline therefore this is the more primitive position. Some of the widely accepted theories are based on reasoning no more sound than this.

No new theories have been presented in this article, for according to Snodgrass (1958, p. 26) arthropod morphology is overburdened with theories, and *Astymachus japonicus* and *Scelioencyrtus mymaricoides* attest to the soundness of this assertion.

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